

UNITED STATES PATENT APPLICATION

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for

**A TRANSMISSION BRAKE**

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## **A TRANSMISSION BRAKE**

[0001] This application is a continuation of pending International Patent Application No. PCT/SE01/02809 filed December 18, 2001, which designates the United States and claims priority of pending Swedish Application No. 0004715-9 filed December 20, 2000.

### **Field Of The Invention**

[0002] The present invention relates to a transmission brake for a rotational member driven by a motor means in a drive direction, the transmission brake allowing rotation of the rotational member in the opposite direction only to the extent that the motor means rotates in this opposite direction.

### **Background of the Invention**

[0003] The motor means may typically be an electric motor, whereas the rotational member may be its outgoing shaft. When the motor is driven in the drive direction, its rotation shall be transmitted to the shaft. When the motor is deenergized, a rotation in the opposite direction of the shaft shall be prevented, i.e. the shaft shall be locked in that direction. Only when the motor is driven in the opposite direction, the shaft shall rotate in that direction.

### **Summary of the Invention**

[0004] A transmission brake for accomplishing the above function is according to the invention characterized by clutch means between the rotational member and a non-rotational housing and ramp means for accomplishing an engagement of the clutch means at a rotation of the rotational member but not the motor means in said opposite direction.

[0005] A typical use of this transmission brake is in an electric brake, primarily for heavy road vehicles, such as buses, trucks and trailers, but also for rail vehicles. The development at the present time is towards less use of compressed air and more use of electric power in heavy road vehicles as well as in rail vehicles. It is thus quite natural that the possibility to use electric power for braking is being discussed.

[0006] In an electric brake an electric motor is usually used as its brake driving or applying means. When driven in one direction - the drive direction - the motor applies the brake. The brake may normally be a disc brake or a block brake. In the case of a disc brake, a brake lining is brakingly applied against a brake disc. The brake has accordingly to be provided with means for transforming the rotational movement of the motor into a linear movement of the brake lining.

[0007] The electric motor is thus driven in the drive direction for brake application and in the opposite direction for brake release. When the brake has been applied to the desired extent, no more current is normally supplied to the motor, but the brake shall remain applied, until the motor is driven in the opposite direction for brake release.

[0008] The purpose of the transmission brake or coupling is to accomplish this function. Rotation of the motor in the release direction shall unlock the transmission brake or coupling and allow a rotation of the motor shaft.

#### Brief Description of the Drawings

[0009] The invention will be described in further detail below reference being made to the accompanying drawings, in which

[00010] Fig 1 is a section through an electric motor with a first embodiment of a transmission brake according to the invention,

[00011] Fig 2 is a side view of the major part of the transmission brake,

[00012] Fig 3 is another side view - 90° turned in relation to Fig 2 of the transmission brake,

[00013] Fig 4 is a section through the transmission brake along the line IV-IV in Fig 3,

[00014] Fig 5 is a section substantially corresponding to Fig 1 but 90° turned and with certain parts of the electric motor omitted,

[00015] Fig 6 is section through an electric motor with a second embodiment of a transmission brake according to the invention,

[00016] Fig 7 is a side view generally corresponding to Fig 6 but to a smaller scale, and

[00017] Fig 8 is a sectional view along the line VIII-VIII in Fig 6.

#### Detailed Description of the Drawings

A first embodiment according to Figs 1-5

[00018] In a motor housing 1 with a cover 2 a stator 3 is attached. A shaft 4 is journaled in the housing 1 by a first bearing 5 and in the cover 2 by a second bearing 6. The shaft 4 is provided with a gear 7 at its end extending out of the housing 1. This gear 7 is intended for connection to further parts of an electric disc brake arrangement, which are not further described.

[00019] The shaft 4 is provided with a ramp ring 8, which is journaled on the shaft and is to be further described, and coaxially outside thereof a rotor 9. At the supply of electric power the stator 3 and the rotor 9 will cooperate to form an electric motor rotationally driving the shaft 4, either in a direction for brake application or the opposite direction for brake release.

[00020] A driver pin 10 extends through the shaft 4. This pin 10 is in practice constructed of several parts but is regarded as one unit. The pin is, however, provided with elastic sleeves 10' at both ends. As is most clearly shown in Fig 4, the ramp ring 8 is provided with recesses for the pin 10 and is rotatably arranged on the shaft 4, which means that there is a certain rotational play 11 between the shaft 4 and the ramp ring 8.

[00021] A splines ring 12 is arranged on the shaft 4 over a one-way coupling 13. A brake disc 14 is in splines engagement with the splines ring 12 and is provided with friction material 14'. It is biased by compression springs 15 in the cover 2 via spring bearings 16 against a lamella 17, which is rotationally locked to the cover 2. The compression springs 15 may have the form of belleville washers.

[00022] Rollers 18 (Figs 2 and 5) are arranged between the ramp ring 8 and a ramp sleeve 19 and are acting between corresponding ramp surfaces 8' and 19' on these parts, as is indicated in Fig 2. The ramp sleeve 19 is rotationally locked in relation to the shaft 4 by recesses 19" for the driver pin 10 (Fig 3).

[00023] When the ramp ring 8 is turned in relation to the shaft 4, the rollers 18 roll up the ramp surfaces 8' and 19', so that a play 20 between the brake disc 14 and the ramp sleeve 19 is consumed and the springs 15 are compressed, which means that the friction between the friction material 14'

and the lamella 17 disappears. The reaction force is hereby taken up by an axial bearing 21.

#### Function

[00024] When the electric motor rotates in the direction for brake application, the ramp ring 8 carries the shaft 4 with it. The shaft 4 rotates in the non-locking direction of the one-way coupling 13.

[00025] When the electric motor is stopped, so that the torque on the ramp ring 8 disappears and the shaft 4 has a tendency to rotate in the opposite direction or brake release direction, this rotation is blocked by the one-way coupling 13 and the brake disc 14.

[00026] When the electric motor is rotated in the opposite direction for brake release, the ramp ring 8 will move rotationally in the play 11, so that the rollers 18 roll up the ramp surfaces 8' and 19' and the friction between the friction material 14' on the brake disc 14 and the lamella 17 ceases. Finally, the brake disc 14 and thus the shaft 4 will be allowed to rotate in the brake release direction.

A second embodiment according to Figs 6-8

[00027] The second embodiment has many similarities with the first embodiment, although in this case the transmission brake is not built into the electric motor. Accordingly the same reference numerals - with the addition of an "A" - are used for corresponding parts.

[00028] We thus recognize the housing 1A, the cover 2A, the stator 3A, the cover bearing 6A, and the rotor 9A. The shaft 4A is rotationally movably attached to the rotor 9A by means of a screw 9A' and has a gear 7A.

[00029] The ramp ring 8A is arranged on the rotor 9A, whereas the shaft 4A is provided with a shaft hub 4A'. Cylindrical driver elements 10A are - as shown in Fig 8 - arranged in the shaft hub 4A' and extend into recesses in the ramp ring 8A, so that there is a certain rotational play 11A between the shaft 4A (or rather its hub 4A') and the ramp ring 8A. The driver elements 10A are elastic.

[00030] As has been stated, this second transmission brake is arranged outside the electric motor and accordingly has to have its own housing 1A', which is held stationary in a way not shown.

[00031] The following parts in the housing 1A' can be recognized, although differently designed: the splines ring 12A, the one-way coupling 13A, the brake discs 14A connected to the splines ring 12A, the compression spring 15A, the bearing 16A, the lamellas 17A connected to the housing 1A', the rollers 18A, the ramp sleeve 19A being rotationally locked to the shaft hub 4A' at 19A'', the axial play 20A formed between the ramp sleeve 19A and push pins 22A extending through the brake discs 14A (except the one furthest to the right in Fig 6), and the axial bearing 21A.

[00032] The function of the second embodiment now described corresponds to that of the first embodiment.